

**ACFER 066 (LL3-6) - PETROLOGIC AND TRACK STUDY OF A SPECTACULAR REGOLITH BRECCIA;** A. Jäckel<sup>1</sup>, J. Romstedt<sup>2</sup>, A. Bischoff<sup>1</sup>,  
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**Introduction:** According to Keil [1] the ordinary chondrites show different abundances of brecciation: about 62% of LL-group chondrites are brecciated whereas H- and L-group chondrites are less brecciated (25% and 10%, respectively). In order to obtain more detailed information about the complex processing and reprocessing of material on the LL-chondritic parent body we studied different brecciated meteorites. Breccias are characterized by different kinds of mm-sized fragments, like impact melt rock clasts, dark lithic clasts, breccia fragments and metamorphosed clasts of various petrologic types embedded within a fine-grained matrix. Although 62% of the LL-chondrites are brecciated, only a few of them are regolith breccias (Adzhi Bogdo, Holman Island, Ngawi, St. Mesmin and Vishnupur). These breccias represent samples from the parent body surface. They are characterized by the presence of solar cosmic ray tracks and significant concentrations of solar noble gases. In this respect, Acfer 066 is a very interesting sample. A polished thin section of Acfer 066, a LL3-6, S2, W3 chondritic breccia from the Algerian part of the Sahara [2], was studied by Scanning Electron Microscopy (SEM) and an electron microprobe. Another thin section of this sample was etched (0.5 h) in WN-solution at standard conditions [3] to reveal nuclear tracks in olivines [4].

**Results:** Fig. 1 shows the brecciated nature of this sample. The textures and mineral compositions of various types of fragments as well as those of the fine-grained matrix were investigated. Only the most common lithologies will be characterized below:

Impact melt rock clasts: In Acfer 066 impact melt rock clasts were identified. Within these fragments zoned euhedral olivines (Fa<sub>12-30</sub>; Fig. 2a) are embedded in a feldspar-normative mesostasis. In some cases skeletal crystals of calcium-rich pyroxenes were observed.

Metamorphosed clasts: Many equilibrated, highly recrystallized fragments with a granoblastic texture were identified (Type 6). Both, pyroxenes (Fs<sub>21-25</sub>) and olivines (Fa<sub>28-32</sub>; Fig. 2b) are well equilibrated. The typical intergranular angle of 120° that is due to recrystallization can be observed.

Host matrix: The chondrule and mineral fragments in Acfer 066 are surrounded by a fine-grained clastic matrix showing high porosity and consisting of a mixture of equilibrated and of unequilibrated minerals. The Fa-content of the olivines varies between 1 and 32 mol% (Fig. 2c) with a peak at about 28-32 mol%.

Track study: The track investigation reveals the occurrence of preirradiated olivines. These olivines were irradiated by solar cosmic rays on the parent body surface. Three irradiated grains were discovered within a breccia fragment indicating that at least this fossil fragment represents a regolith breccia that is older than the bulk Acfer 066 regolith breccia itself.

**Discussion:** In Acfer 066 various types of fragments with different Fa-contents of the olivines were identified. These mm-sized fragments of various petrologic types are embedded within a fine-grained clastic matrix with high porosity. Based on the existence of solar cosmic ray tracks and significant concentrations of solar noble gases this sample is a regolith breccia. For the first time a fossil regolith breccia was identified representing an earlier generation of lithified regolith that was mixed again into the active parent body regolith. Therefore, Acfer 066 is a spectacular rock showing the complexity of fundamental regolith processes on the parent body surface.

**References:** [1] Keil K. (1982) *LPI Tech. Rep.* 82-02; [2] Jäckel A. and Bischoff A. (1996) *Meteoritics & Planet. Sci.*, 31, 4, Supp., A66-A67 (abstr.); [3] Krishnaswami S. et al. (1971) *Science*, 174, 287-291; [4] Romstedt J. and Jäckel A. (1996) *Meteoritics & Planet. Sci.*, 31, 4, Supp., A117-A118 (abstr.).

ACFER 066 REGOLITH BRECCIA (LL3-6): Jäckel A. et al.

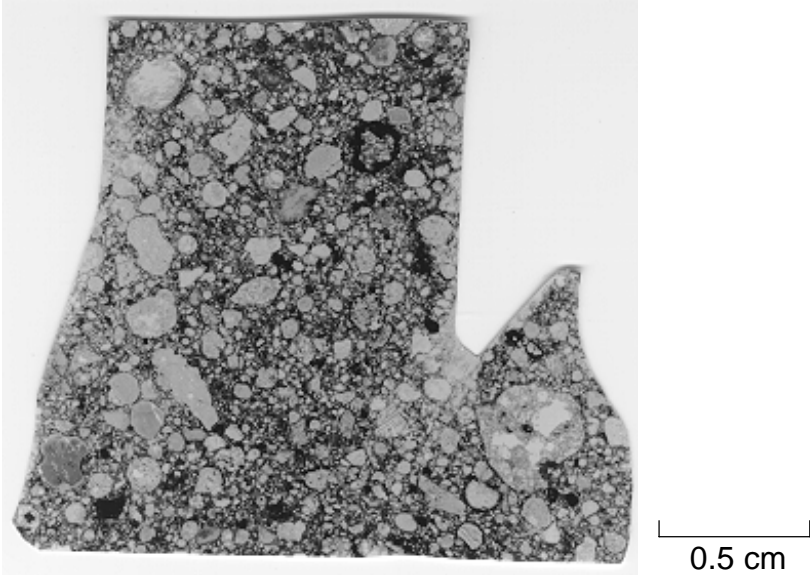


Figure 1: Transmitted light photomicrograph showing the brecciated nature of Acfer 066. Various types of chondrule and lithic fragments are embedded within a fine-grained clastic matrix.

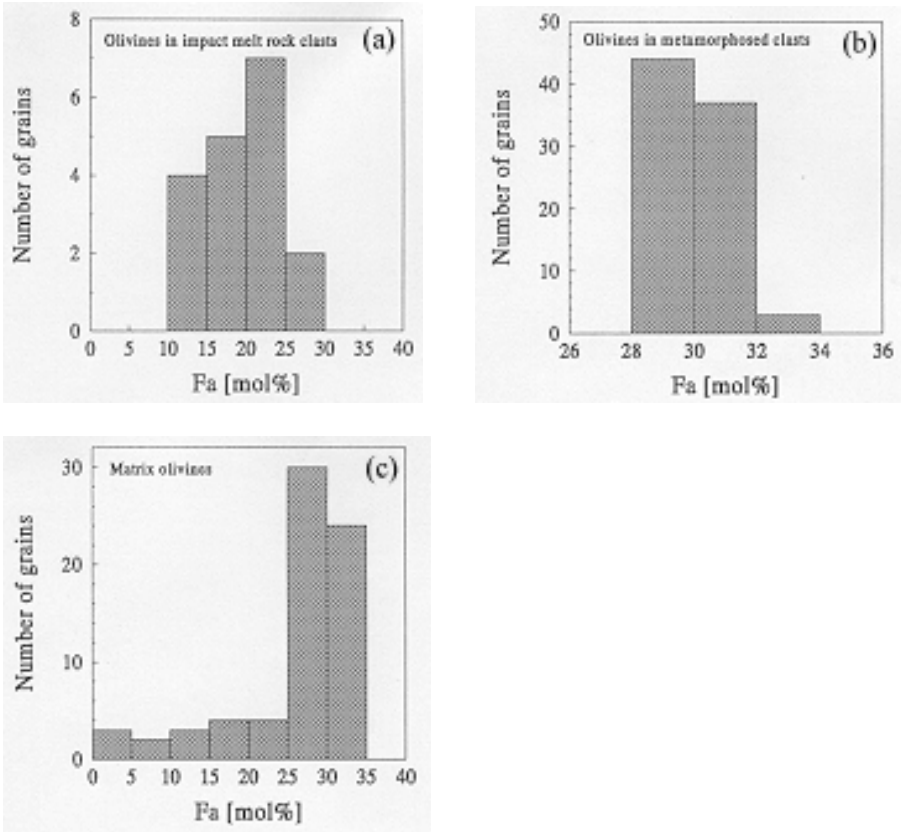


Figure 2: Composition of olivines within impact melt rock clasts (a), within metamorphosed clasts (b) and within the matrix (c) of Acfer 066.